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Author(s): LYNN P. BRANDENBERGER, JAMES W. SHREFLER, CHARLES L. WEBBER III, RONALD E. TALBERT, MARK E. PAYTON, LYNDA K. WELLS, and MARILYN McCLELLAND
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LYNN P. BRANDENBERGER, JAMES W. SHREFLER, CHARLES L. WEBBER III, RONALD E. TALBERT, MARK E. PAYTON, LYNDA K. WELLS, and MARILYN MCCLELLAND[2]

Abstract: Studies were conducted at eight sites during a 3-yr period in Oklahoma and Arkansas to determine the effectiveness and safety of preemergence applications of halosulfuron both alone and in tank mixtures with bensulide, clomazone, ethalfluralin, and naptalam. Ethalfluralin, naptalam plus bensulide, and sulfentrazone also were applied alone. Although halosulfuron caused up to 20% seedling stunting, watermelon plants recovered by 5 to 7 wk after planting, and yield was similar to that of hand-weeded plots. Halosulfuron treatments controlled hophornbeam copperleaf, Palmer amaranth, carpetweed, and cutleaf groundcherry 80 to 100%. Control of goosegrass was at least 97% with clomazone plus ethalfluralin plus halosulfuron. Injury to watermelon treated with sulfentrazone ranged from 76 to 98% at 2 to 4 wk after treatment. This was reflected by yields that were lower than any other herbicide treatment in the studies.

Nomenclature: Bensulide; clomazone; ethalfluralin; halosulfuron; naptalam; sulfentrazone; hophornbeam copperleaf, *Acalypha ostryifolia* Riddell #[3] ACCOS; Palmer amaranth, *Amaranthus palmeri* S. Wats. # AMAPA; goosegrass, *Eleusine indica* (L.) Gaertn. # ELEIN; carpetweed, *Mollugo verticillata* L. # MOLVE; cutleaf groundcherry, *Physalis angulata* L. # PHYAN; watermelon, *Citrullus lanatus* 'Jubilee', 'XIT 101', 'Crimson Sweet'.

Additional index words: Broadleaf weed control, watermelon injury.

Abbreviations: PRE, preemergence; WAT, weeks after treatment.

INTRODUCTION

Weeds are detrimental to vegetable production, causing increased costs associated with control efforts, difficulty in harvesting, and reductions in crop quality and yield. In a 2002 survey of weeds in eight southern states, pigweed species (*Amaranthus* spp.) were cited as being both prevalent and some of the most troublesome weeds for cucurbit crops (Webster 2002). Also mentioned as troublesome in the survey were carpetweed and hophornbeam copperleaf. Several pigweed species are serious competitors of field crops throughout the United States (Mayo et al. 1995). Interference from these weeds has reduced soybean (*Glycine max*) yield up to 79% and cotton (*Gossypium hirsutum*) yield up to 34% (Bensch et al. 2003; Rushing et al. 1985). Hophornbeam copperleaf is an increasing weed problem for producers in the southcentral United States, particularly as peanut (*Arachis hypogaea*) acreage is shifted into vegetable production (Mason et al. 1975). During field experiments in Oklahoma, a loss in yield of as much as 76% was recorded for peanut because of competition with hophornbeam copperleaf (Baldwin et al. 1974). Few reports have appeared regarding the effect of carpetweed or cutleaf groundcherry (*Physalis angulata*) in field and vegetable crops, but both weed species are distributed throughout the southern United States. Although mentioned by several authors, little has been reported regarding competition from these two species (Bell and Oliver 1979; Hoyt et al. 1996; Porter 1993; Wilhm et al. 1979). However, Bell and Oliver (1979) did mention that competition from cutleaf groundcherry had no significant effect on soybean yield in Arkansas. Goosegrass is a competitive weed species in several areas of the southern United States and other production areas of the world (Flower 2001; La Bonte et al. 1999; Xia et al. 1997). Interference

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[2] First and sixth authors: Associate Professor and Senior Research Specialist, respectively, Department of Horticulture and Landscape Architecture, Oklahoma State, 360 Ag Hall, Stillwater, OK 74078-6027; second author: Area Extension Horticulture Specialist, Wes Watkins Agriculture Research and Extension Center, P.O. Box 128, Lane, OK 74555-0128; third author: Research Agronomist, U.S. Department of Agriculture, Agriculture Research Service, South Central Agricultural Research Laboratory, P.O. Box 159, Lane, OK 74555; fourth and seventh authors: University Professor and Research Associate, respectively, Department of Crop, Soil, and Environmental Sciences, University of Arkansas, 1366 West Altheimer Drive, Fayetteville, AR 72704; fifth author: Professor of Statistics, Oklahoma State University, 301 Math Sci., Stillwater, OK 74078. Corresponding author's E-mail: lynn.brandenberger@okstate.edu.

[3] Letters following this symbol are a WSSA-approved computer code from *Composite List of Weeds*, Revised 1989. Available only on computer disk from WSSA, 810 East 10th Street, Lawrence, KS 66044-8897.

Table 1. Location information, including planting dates, watermelon cultivars, soil organic matter, soil pH, and soil description.

Location	Planting date	Watermelon cultivar	Soil organic matter	Soil pH	Soil description
			%		
Bixby	6/01/00	'Jubilee'	0.8	5.9	Severn very fine sandy loam (Typic Udifluvents)
Bixby	5/17/01	'Jubilee'	0.8	5.9	Severn very fine sandy loam (Typic Udifluvents)
Bixby	6/03/02	'XIT 101'	0.8	5.9	Severn very fine sandy loam (Typic Udifluvents)
Caddo	6/08/00	'Sangria'	1.0	6.0	Pond Creek silt loam (Pachic Argiustolls)
Hughes	5/16/01	'Jubilee'	2.0	7.1	Eufaula fine sand (Psammentic Paleustalfs)
Kibler	4/25/01	'Crimson Sweet'	0.8	6.3	Roxanna silt loam (Typic Udifluvents)
Kibler	5/01/02	'Crimson Sweet'	0.8	6.3	Roxanna silt loam (Typic Udifluvents)
Lane	6/27/00	'Jubilee'	0.7	6.2	Stigler very fine sandy loam (Aquic Paleudalf)
Lane	6/19/02	'Jubilee'	0.7	6.2	Stigler very fine sandy loam (Aquic Paleudalf)

from goosegrass and other annual grasses reduced the dry weight of tobacco (*Nicotiana tabacum*) seedlings by 80% (Flower 2001). Goosegrass interference also reduced the weight of sweet potato (*Ipomoea batatas*) transplants by 16% (Monks et al. 1996).

Control of these weed species by preemergence (PRE) or postemergence applications of herbicides has been documented (Baldwin et al. 1974; Bell and Oliver 1979; Culpepper et al. 2001; Eizenberg et al. 2003; Hartzler and Foy 1983; Wilhm et al. 1979), but little work has been reported on the use of sulfonylurea herbicides for weed control in watermelon. Halosulfuron is a systemic, sulfonylurea herbicide (Vencill 2002) that was first developed for weed control in corn and grain sorghum and currently is being developed for use in several vegetable crops. Halosulfuron has both PRE and postemergence activity on several weed species (Talbert et al. 1998). Other cucurbits, including muskmelon (*Cucumis melo* L. *Reticulatus* group) and cucumber (*Cucumis sativus*), have shown tolerance to halosulfuron (Buker and Stall 2001; Miller and Libbey 1999). Other investigators have studied combinations of herbicides to broaden weed control in melon crops (Boyhan et al. 1995; Umeda 2002). Several weeds, including hophornbeam copperleaf, cutleaf ground cherry, carpetweed, and annual grasses, are not listed as weed species controlled by halosulfuron (Anonymous 2003); therefore, testing is needed to determine the efficacy of halosulfuron for control of these and other weed species.

The purpose of these studies was to determine the crop safety and effectiveness of halosulfuron applied PRE both alone and in tank mixtures with other PRE herbicides in direct-seeded watermelon for control of annual weeds in the southcentral United States.

MATERIALS AND METHODS

Study Site Information. Field studies were conducted at experimental stations in the years 2000, 2001, and 2002 at Bixby, OK; in 2000 and 2002 at Lane, OK; and in 2001 and 2002 at Kibler, AR. Commercial sites were used in Caddo County, OK, in 2000 and in Hughes County, OK, in 2001. Site information, including soil descriptions, pH, organic matter, planting dates, and cultivars used, are included in Table 1.

Native weed populations were evaluated in each test. Of the five weed species in the studies, Palmer amaranth was present in seven tests at four sites, carpetweed in five tests at three sites, and hophornbeam copperleaf, goosegrass, and cutleaf groundcherry either in two different seasons or at two different test sites (Table 2).

At each site, watermelon was direct-seeded from late April to late June, as appropriate for the site, into a flat, smooth seedbed prepared just before planting (Table 1).

Table 2. Test sites and WAT that each weed species was evaluated.[a]

	WAT for ratings at each location and year								
	Bixby, OK			Caddo, OK	Hughes, OK	Kibler, AR		Lane, OK	
Weed species	2000	2001	2002	2000	2001	2001	2002	2000	2002
Hophornbeam copperleaf	6	—	—	—	5	—	—	—	—
Palmer amaranth	6	3, 6	2, 6	6	5	2, 4	2, 6	—	—
Goosegrass	—	—	—	—	—	2, 5	2, 6	—	—
Carpetweed	6	—	2, 6	—	5	—	—	4	3, 7
Cutleaf groundcherry	—	—	—	—	—	—	—	4	3, 7

[a] Abbreviations: WAT, weeks after treatment; —, species not present.

Seeds were planted with a hand-pushed planter[4] at the Oklahoma locations and with a tractor-mounted research cone planter[5] at Kibler, AR. Plot size was one row, with 2.7 to 3.7 m between row centers and a length of 7.6 to 10 m. Watermelon plants were thinned to 0.6 to 1 m between plants at 1 to 2 wk after emergence. All sites were irrigated by overhead sprinkler irrigation except for the Hughes County site, which was not irrigated. Crop cultural requirements were met in a manner similar to that in commercial fields except that herbicide-treated plots were not hand weeded or cultivated. A weedy and weed-free control was included at most sites. Hand weeding was initiated for weed-free controls at 2 to 3 wk following the start of studies and on an as-needed basis following the initial weeding.

[4] Planet Jr. Powell Manufacturing Company, P.O. Box 707, Bennettsville, SC 29512-0707.

[5] Hege model 80. H & N Equipment Company, Route 1 Box 34A, Colwich, KS 67030.

Experimental Procedure. Each study site was arranged in a randomized complete block design with four replications. Herbicide treatments are listed in Table 3. All applications were PRE to the crop and weeds and were applied with a CO_2-pressurized, four-nozzle, hand-boom sprayer[6] calibrated to deliver 187 to 281 L/ha at pressures of 124 to 221 kPa.

Data Collection and Statistical Analysis. Visual ratings for percentage crop injury and control of each weed species were recorded at 2 to 4 and at 5 to 7 wk after treatment (WAT) on a scale of 0% (no control or injury) to 100% (complete control or plant death). Melons at Bixby, OK, in 2000, 2001, and 2002 and at Lane, OK, in 2002 were harvested once. Melons at Kibler, AR, were harvested three times in 2001, but no yield data were recorded in 2002. Yield data included the number and weight of individual marketable fruit for each plot;

[6] DGTeeJet 11004, DGTeeJet 11003, and TeeJet 8002 VS spray nozzles. Spraying Systems Co., P.O. Box 7900, Wheaton, IL 60189-7900.

Table 3. Test sites and treatments evaluated at each site.

		Location and year[a]								
		Bixby, OK			Caddo, OK	Hughes, OK	Kibler, AR		Lane, OK	
Herbicide treatment[b]	Rate	2000	2001	2002	2000	2001	2001	2002	2000	2002
	kg ai/ha									
Nontreated, weedy	0	x	x	x	x	x	x	x	x	x
Nontreated, hand-weeded	0	x	x	x	x	x	—	—	x	x
Halosulfuron	0.02	—	x	x	—	x	—	—	—	—
Halosulfuron	0.03	x	x	x	x	x	—	—	x	x
Halosulfuron	0.04	—	x	x	—	x	—	—	—	x
Halosulfuron	0.05	—	x	x	x	x	—	—	—	x
Halosulfuron +	0.03	x	x	x	x	x	—	—	x	x
ethalfluralin	0.84									
Halosulfuron +	0.03	x	x	x	x	x	—	—	x	x
ethalfluralin	1.68									
Halosulfuron +	0.03	x	x	x	x	x	—	—	x	x
naptalam	3.37									
Halosulfuron +	0.03	x	x	x	x	x	—	—	x	x
bensulide	5.61									
Naptalam +	3.37	x	x	x	x	x	—	—	—	x
bensulide	5.61									
Ethalfluralin	1.68	x	x	x	x	x	—	—	x	x
Sulfentrazone	0.22	—	—	x	—	—	—	—	—	x
Sulfentrazone	0.45	—	—	x	—	—	—	—	—	x
Clomazone +	0.17	—	—	—	—	—	x	x	—	—
ethalfluralin +	0.63									
halosulfuron	0.02									
Clomazone +	0.17	—	x	x	—	x	x	x	—	—
ethalfluralin +	0.63									
halosulfuron	0.03									
Clomazone +	0.17	—	x	x	—	x	x	x	—	—
ethalfluralin +	0.63									
halosulfuron	0.04									

[a] Abbreviations: x, treatment was evaluated at the location; —, treatment was not evaluated at the location.

[b] Bensulide was Prefar 4-E®, 480 g ai/L. Clomazone was Command 3 ME®, 360 g ai/L. Ethalfluralin was Curbit EC®, 360 g ai/L. Halosulfuron was Sandea®, 75% ai. Naptalam was Alanap-L®, 240 g ai/L. Sulfentrazone was Authority®, 75% ai.

Table 4. Control of hophornbeam copperleaf, Palmer amaranth, goosegrass, carpetweed, and cutleaf groundcherry at 2 to 4 and 5 to 7 WAT with PRE treatments, averaged over locations[a,b]

		Weed control 2 to 4 and 5 to 7 WAT[c]								
		Hophornbeam copperleaf	Palmer amaranth		Goosegrass		Carpetweed		Cutleaf groundcherry	
Herbicide treatment	Rate	5 to 7	2 to 4	5 to 7	2 to 4	5 to 7	2 to 4	5 to 7	2 to 4	5 to 7
	kg ai/ha	%								
Nontreated, weedy	0	0 d	0 e	0 c	0 b	0 b	0 c	0 e	0 d	0 c
Nontreated, hand-weeded	0	—	24 d	84 b	—	—	10 c	78 bc	90 ab	99 a
Halosulfuron	0.02	—	91 bc	93 a	—	—	100 a	64 c	—	—
Halosulfuron	0.03	79 ab	98 ab	96 a	—	—	86 b	91 ab	96 a	99 a
Halosulfuron	0.04	—	97 ab	96 a	—	—	100 a	97 a	99 a	99 a
Halosulfuron	0.05	—	97 ab	97 a	—	—	100 a	98 a	99 a	99 a
Halosulfuron +	0.03	90 ab	99 ab	98 a	—	—	99 a	98 a	95 a	99 a
ethalfluralin	0.84									
Halosulfuron +	0.03	80 ab		99 a	—	—	98 ab	99 a	99 a	99 a
ethalfluralin	1.68		99 ab							
Halosulfuron +	0.03	96 a	94 abc	96 a	—	—	85 b	93 a	94 a	99 a
naptalam	3.37									
Halosulfuron +	0.03	97 a	98 ab	97 a	—	—	90 ab	93 a	96 a	97 a
bensulide	5.61									
Naptalam +	3.37	24 c	85 c	85 b	—	—	88 ab	18 d	68 b	25 b
bensulide	5.61									
Ethalfluralin	1.68	62 b	99 ab	91 ab	—	—	86 b	97 a	49 c	30 b
Sulfentrazone	0.22	—	100 a	100 a	—	—	100 a	100 a	99 a	99 a
Sulfentrazone	0.45	—	100 a	100 a	—	—	100 a	100 a	99 a	99 a
Clomazone +	0.17	—	100 a	95 a	100 a	88 a	—	—	—	—
ethalfluralin +	0.63									
halosulfuron	0.02									
Clomazone +	0.17	—	100 a	96 a	100 a	87 a	100 a	98 a	—	—
ethalfluralin +	0.63									
halosulfuron	0.03									
Clomazone +	0.17	—	100 a	98 a	100 a	83 a	100 a	97 a	—	—
ethalfluralin +	0.63									
halosulfuron	0.04									

[a] Abbreviations: PRE, preemergence; WAT, weeks after treatment; —, treatment was not evaluated at the location.

[b] Hophornbeam copperleaf was evaluated at Bixby, OK, in 2000 and at Hughes, OK, in 2001. Palmer amaranth was evaluated at Bixby, OK, in 2000, 2001, and 2002; at Caddo, OK, in 2000; at Hughes, OK, in 2001; and at Kibler, AR, in 2001 and 2002. Goosegrass was evaluated at Kibler, AR, in 2001 and 2002. Carpetweed was evaluated at Bixby, OK, in 2000 and 2002; at Hughes, OK, in 2001; and at Lane, OK, in 2000 and 2002. Cutleaf groundcherry was evaluated at Lane, OK, in 2000 and 2002.

[c] Means in each column followed by the same letter are not different at the ≤0.05 level of significance.

from these data, both marketable yield and average fruit weight were determined. A marketable fruit weighs at least 2.3 kg. Yield was reported as Mg/ha for total marketable yield from each treatment. All data were analyzed using analysis of variance with PROC MIXED in PC SAS Version 8.2 software.[7] Percentage data were transformed using the arcsine square-root transformation but did not affect the results of the analysis. A split-plot arrangement in a randomized complete block design was assumed, with replications within locations serving as blocks and time serving as the split unit factor (when appropriate). For the analyses involving time, simple effects of treatment at a given time period were analyzed with a SLICE option in an LSMEANS statement. When the SLICE option was significant at a 0.05 significance level, multiple comparisons for treatment were performed using a DIFF option (i.e., protected pairwise *t* tests) at a 0.05 significance level.

[7] SAS Institute, Inc., 100 SAS Campus Drive, Cary, NC 27513.

RESULTS AND DISCUSSION

Weed Control. Halosulfuron at 0.03 kg/ha applied either alone or in combination with other herbicides controlled hophornbeam copperleaf 79 to 97% (Table 4). Control with ethalfluralin alone was only 62%, but no advantage was found to combining halosulfuron with ethalfluralin for controlling hophornbeam copperleaf. Control with halosulfuron plus naptalam and with halosulfuron plus bensulide, however, was better than that with either naptalam plus bensulide (24%) or with ethalfluralin alone. More definitive data are needed for these herbicides on hophornbeam copperleaf before recommendations for halosulfuron applied alone can be made. However, halosulfuron shows potential to control this weed.

Palmer amaranth control from halosulfuron and combinations of halosulfuron with other herbicides ranged from 91 to 100% at 2 to 4 WAT and from 93 to 99% at 5 to 7 WAT (Table 4). Johnson and Mullinix (2002) reported smooth pigweed (*Amaranthus hybridus* L.) control of 89 and 90% with halosulfuron plus ethalfluralin and with ethalfluralin alone, respectively. Palmer amaranth was controlled 100% with sulfentrazone applied at 0.22 and 0.45 kg/ha. Brown and Masiunas (2002) reported 91 to 99% control of redroot pigweed (*Amaranthus retroflexus* L.) with sulfentrazone at 3 WAT and 77 to 94% control at 6 WAT. In our experiments, spiny amaranth (*Amaranthus spinosus* L.) and tumble pigweed (*Amaranthus albus* L.) also were evaluated at Lane, OK. Control of these species with halosulfuron was similar to that of Palmer amaranth, so data are not presented in tabular form. These data suggest that tank-mix partners for halosulfuron probably are not necessary for *Amaranthus* control.

Response of goosegrass to clomazone plus ethalfluralin plus halosulfuron was similar regardless of which rate of halosulfuron was used in the tank mixtures (Table 4). Control was 100% for each of the three combinations at 2 to 4 WAT and ranged from 83 to 88% at 5 to 7 WAT. Scott et al. (2002) reported 74 to 100% control of goosegrass with clomazone applied PRE at 0.8 kg/ha, and Westberg et al. (1989) reported 100% control of goosegrass with clomazone applied PRE.

All treatments controlled carpetweed at least 85% at 2 to 4 WAT (Table 4). By 5 to 7 WAT, control was at least 91% except with halosulfuron alone at 0.02 kg/ha (64% control) and with naptalam plus bensulide (18% control). Boyhan et al. (1995) also reported poor control of carpetweed with naptalam plus bensulide.

Cutleaf groundcherry was controlled 94 to 99% with treatments containing halosulfuron or sulfentrazone (Table 4). Control with ethalfluralin alone and with naptalam plus bensulide was 68% or less at 2 to 4 WAT and 30% or less at 5 to 7 WAT.

Table 5. Watermelon injury and yield from PRE treatments, averaged over locations.[a,b]

Herbicide treatment	Rate	Watermelon injury 2 to 4 WAT	Watermelon injury 5 to 7 WAT	Watermelon yield[c]
	kg ai/ha	%	%	Mg/ha
Nontreated, weedy	0	0 h	0 g	9 d
Nontreated, hand-weeded	0	3 gh	3 g	24 bc
Halosulfuron	0.02	9 efgh	7 efg	30 ab
Halosulfuron	0.03	17 e	11 defg	29 ab
Halosulfuron	0.04	20 de	8 efg	30 ab
Halosulfuron	0.05	40 c	17 cde	27 ab
Halosulfuron + ethalfluralin	0.03 0.84	12 ef	8 efg	27 ab
Halosulfuron + ethalfluralin	0.03 1.68	26 d	19 cd	28 ab
Halosulfuron + naptalam	0.03 3.37	13 ef	7 fg	29 ab
Halosulfuron + bensulide	0.03 5.61	15 ef	9 efg	28 ab
Naptalam + bensulide	3.37 5.61	3 gh	5 g	25 bc
Ethalfluralin	1.68	8 fgh	15 def	27 ab
Sulfentrazone	0.22	76 b	52 b	17 c
Sulfentrazone	0.45	98 a	87 a	8 d
Clomazone + ethalfluralin + halosulfuron	0.17 0.63 0.02	13 ef	15 def	—
Clomazone + ethalfluralin + halosulfuron	0.17 0.63 0.03	21 de	19 cd	28 ab
Clomazone + ethalfluralin + halosulfuron	0.17 0.63 0.04	30 d	26 c	32 a

[a] Abbreviations: PRE, preemergence; WAT, weeks after treatment; —, yield data not obtained.

[b] Locations were Bixby, OK, in 2000, 2001, and 2002; Caddo, OK, in 2000; Hughes, OK, in 2001; Lane, OK, in 2000 and 2002; and Kibler, AR, in 2001 and 2002.

[c] Means in each column followed by the same letter are not different at the ≤0.05 level of significance.

Crop Injury. Halosulfuron at 0.02, 0.03, or 0.04 kg/ha; halosulfuron at 0.03 kg/ha plus ethalfluralin at 0.84 or 1.68 kg/ha; naptalam at 3.37 kg/ha; or bensulide at 5.61 kg/ha; and clomazone plus ethalfluralin plus halosulfuron at 0.02, 0.03, or 0.04 kg/ha injured watermelon plants 9 to 30% (stunting) compared to the nontreated, weedy, or hand-weeded controls at 2 to 4 WAT (Table 5). Injury from treatments that included halosulfuron at 0.05 kg/ha and sulfentrazone at 0.22 and 0.45 kg/ha was excessive (40 to 98% injury). Halosulfuron injury was manifested primarily as stunting of vines and foliage. Injury from halosulfuron applied PRE also was reported by Fennimore et al. (1999) on cantaloupe (*Cucumis melo*). By 5 to 7 WAT, injury had declined for most treatments containing halosulfuron. However, injury from halosulfuron at 0.05 kg/ha, halosulfuron at 0.03 kg/ha plus ethalfluralin at 1.68 kg/ha, ethalfluralin alone, and the three tank mixtures of clomazone plus ethalfluralin plus halosulfuron was 15 to 26% higher than that in the nontreated plants. Early and late injury from halosulfuron was higher than that reported by Fennimore and Richard (1999) on cantaloupe (8 to 13%), but they also noted a reduction in injury over time.

Injury to watermelon plants from sulfentrazone was severe (76 to 98%) at 2 to 4 WAT (Table 5). Injury was manifested as severe stunting or death of emerged seedlings. Most plants failed to recover, and injury was 52 to 87% at 5 to 7 WAT. Fennimore and Richard (1999) reported similar injury (45 to 90%) at 3 to 7 WAT with similar rates of sulfentrazone on cantaloupe.

Watermelon Yields. Watermelon yields were not reduced by early injury caused by any of the herbicide treatments except for sulfentrazone. Yield of watermelon treated with halosulfuron, tank mixes with halosulfuron, naptalam plus bensulide, and ethalfluralin alone ranged between 25 to 32 Mg/ha compared to 9 Mg/ha for nontreated, weedy plots (Table 5). However, sulfentrazone at 0.45 kg/ha reduced yield to the level of the nontreated, weedy control. Yield reduction resulted from severe injury of watermelon plants from sulfentrazone, which led to fewer fruits per plant. Fruit size (average fruit weight) was not affected by herbicide treatments, which indicates that fruit maturity was not delayed (data not shown). The low yields from sulfentrazone correspond to those reported by Brown and Masiunas (2002) at a site that also had soil organic matter levels of less than 1%. Fennimore and Richard (1999) reported similar levels of crop injury on cantaloupe from sulfentrazone.

In summary, although halosulfuron applied PRE caused obvious early stunting of seedling watermelon plants, watermelon recovered by 5 to 7 wk after planting, and yields were not reduced by the rates and application methods used in these studies. High levels for control of all the broadleaf weed species evaluated resulted from treatments that included halosulfuron, which is in agreement with results from other research (Brown and Masiunas 2002; Umeda 2002). Control of goosegrass was excellent with clomazone plus ethalfluralin plus halosulfuron, but further study is needed to verify which components of the combination controlled this weed species. Further evidence of both weed control and crop safety from halosulfuron both alone and in combination is made evident from higher yields for these treatments compared to the nontreated weedy control. Although four different cultivars were used in these studies and cultivar responses to treatments were not a factor, further study is needed to determine if response to halosulfuron either alone and in tank mixes will vary among cultivars. The yield of watermelon treated with sulfentrazone at 0.45 kg/ha was lower than the yield of watermelon treated with other herbicide treatments in the studies, which is in agreement with observations from Wells (1999). Based on the results of these studies, the authors conclude that halosulfuron alone will provide a much-needed tool for the control of broadleaf weeds and that combinations with other herbicides applied PRE will increase the spectrum of control of both broadleaf and grassy weeds for use in commercial watermelon production.

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